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ABSTRACT

Lack of variety in course offerings variety has been identified as one of the most detrimental aspects of today's school curriculum. The latest school reform movement's immediate goal is to increase enrollment in four core areas: math, science, computers, and foreign language. The movement's ultimate goal is to increase student achievement. To observe school characteristics before and after the reform movement's spark by the release of "A Nation at Risk," information from 59 schools' accreditation reports for 1979-80, 1984-85, and 1987-88 was analyzed to determine if the composition of curriculums has changed in the direction of the current reform movement and if those changes have had an effect on student outcomes. There has been a steady and significant increase in the offerings and enrollment in the four core areas. However, increases in math and language course participation were not accompanied by improved test scores. The relationship between test scores and the number of courses taken in a given discipline is not direct and may be counterintuitive. Data are illustrated in tables and graphs. (12 references) (EJS)

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Curriculum Composition: The Reform Movement and Student Outcomes

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Running head: *Curriculum Composition and School Reform*

Paper presented at the American Educational Research Association annual meeting, 1991. Chicago Illinois

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Curriculum Composition: The Reform Movement and Student Outcomes[1]

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"The very 'stuff' of education." Thus, the National Commission on Excellence in Education refers to the curriculum. In order to examine the curriculum, the authors of "A Nation at Risk" (NAR) looked at patterns of courses high school students took in 1964-69 compared with course patterns in 1976-81. The findings are well known; succinctly, they reveal a steady decline in courses such as math, science, and foreign language accompanied by an increase in courses such as physical education, business education, and other non-core courses. The authors of the report claimed that the "curricular smorgasbord, combined with extensive student choice, explains a great deal of where we find ourselves today." The variety of course offerings has been identified by some authors as one of the most detrimental aspects of today's school curriculum (Powell, Farrar and Cohen, 1985).

The NAR report is not the only national document clamoring for increasing enrollments in key curricular areas such as math and science, albeit it may be argued that it is the most widely recognized document in this category. Other documents were concurrent or even preceded NAR (Mortimer et. al., 1982; National Science Board, 1983) spousing a lessening of non-core, peripheral curricular areas, particularly physical and vocational education, and a tightening of core areas, particularly math, science, computers and foreign language. These reports, released in the early 1980's, set in motion the latest wave of reform sweeping American education.

One may evaluate the latest reform movement on the basis of its immediate goals or on the basis of its ultimate goals. The ultimate goal is the true objective of the reform whereas the immediate goal is a means of achieving the objective. Regarding course enrollments, the immediate goal of the reforms was to increase student enrollment in four key areas and the ultimate goal was to increase student achievement. According to Kirst (1990), the latest

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[1]Paper presented at the 1991 Annual Meeting of the American Education Research Association, Chicago, Illinois

wave of reform achieved almost all of its immediate goals, including changes in course-taking patterns in high schools that reflect more emphasis on math, science, foreign language and world history and less emphassis on vocational education and electives. However, he fails to provide data or mention a reliable source to substantiate the claim.

In fact, we can assess how successfully the reform movement achieved its immediate goal by comparing patterns of courses taken by students before and after the documents were released. Assuming that the pattern of courses taken behaves according to what the reform advocated, then we could examine how successfully the reform movement achieved its ultimate goal by studying the relationship between changes in enrollment with changes in student achievement. The systematic examination of these two goals is the object of this paper.

Basic Terms

It is convenient to define some terms that will be widely used in this paper. The definitions are not meant to have universal application and are used only for the purpose of facilitating the presentation of research variables.

High school class schedule: this is a list published by a high school indicating, for each faculty member of the school, the name of the teacher, the name of the courses taught by that teacher in each class period (or teacher assignment such as preparation period), and the student enrollment in each one of the class periods.

Curricular area: a category usually defined at the state level used to unambiguously decide whether a given course belongs or does not belong to it. For example: math, science, English/language arts, social studies, industrial arts, music, and so forth.

Core Curriculum: Customarily, courses have been grouped into "core" and "non-core" curriculum. Included in the "core" category are: mathematics, science, language arts, and social studies. The "non-core" category includes: vocational ed., business, arts and music, physical ed., and others. Two types of courses, foreign languages and computers, have recently attracted special attention. It is quite possible that in the near future these two types of courses will be considered members of the "core" curriculum.

Transition Curriculum: the following curricular areas: computers and foreign language.

Non-Core Curriculum: any other curricular area.

Course offerings (by curricular area): the total number of class periods listed in the class schedule that belong to a given curricular area. This number is reported as a percentage of the total number of valid class periods (that is, exclusive of any non-teaching period). The unit of analysis of course offerings is the school.

Course enrollment (by curricular area): the total number of student-class-periods counted within a given curricular area. This number is reported as a percentage of the total number of student-class-periods. The unit of analysis is the school.

Recent Research on Course Enrollment

Despite its prominence in the national debate on school reform, the "very stuff of education" has not been extensively investigated by education researchers. The absence of researchers participation in the debate of what should be taught in schools is best illustrated by the disappointment expressed by the Program Chair for the Curriculum Studies Division of the American Educational Research Association's annual meeting in 1989: "I was eager to read the proposals of my fellow researchers to learn how they were construing the debate over curriculum...In fact, I found no mention of the matter. Virtually, no papers proposed to join this debate or to examine its historical origins, or its consequences for children" (McNeil, 1990).[2]

A search in the last five years (1985-1990) of the following leading journals in education did not produce one single article on course offerings or enrollment: *American Educational Research Journa!*, *American Journal of Education*, *Comparative Education Review*, *Journal of Curriculum Studies*, *Review of Educational Research*. As a rare exception, the journal *Educational Evaluation and Policy Analysis* contains one article related to course offerings (Haller, Monk, Bear, Griffith and Moss, 1990) in the last five years.

Difficulty of Collecting Curriculum Data

The paucity of studies in the area may reflect the difficulty of collecting and analyzing patterns of course taking data rather than researchers indifference to the topic. Even the authors of "The Shopping Mall High School" (Powell, Farrar and Cohen, 1985), a book dedicated to this very topic, present no data whatsoever. The book does not include a bibliography and the only reference to empirical research is found in a note at the end of

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[2]The next year's meeting was marginally better. Out of 1,000 sessions and over 5,000 individual presentations, only two presentations dealt with the topic of course offerings and enrollments in K-12 institutions.

the book citing the work of George Van Dyke, "Trends in the Development of the high School Offering" published in 1931!

The few recent studies, that have presented data on the topic, have used data sources that were not originally intended to answer questions dealing with course taking patterns. Examples of this are ACT test scores (Bartell and Noble, 1990) and *High School and Beyond* (Haller, Monk, Bear, Griffith and Moss, 1990; West, Miller and Diodata, 1985)

Patterns of course taking belong to the category of "processes variables." The difficulty of collecting these type of education data has been amply acknowledged in the literature of education indicators (Oakes, 1989; Shavelson, McDonnell, Oakes, 1989; Smith, 1988). The other two categories, inputs and outputs, contain data that are easier to collect. Nevertheless, there are institutions dedicated to the collection of processes variables: the school accreditation agencies.

School Accreditation Data

Accreditation data have nice properties such as the periodicity of the collection cycle (usually, an annual event), the existence of accreditation standards (which simplifies measurement issues), and the comprehensiveness of the data (many aspects of schools are examined).

The University of Michigan's Bureau of Accreditation and School Improvement Studies (BASIS) has conducted voluntary accreditation of high schools in Michigan since 1871. As part of its accreditation process, the Bureau sends to the participating schools an annual form to report school data required to ascertain compliance with the accreditation standards. High schools that are dually accredited by BASIS and the Michigan State Committee of the North Central Association (NCA) are required to send to the Bureau a written copy of their Winter class schedule every year.[3] In this paper we describe how we used school class schedule and other accreditation data to evaluate the success in Michigan of both the immediate and the ultimate goals of the latest reform movement.

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[3]Since 1986, the Bureau has sent a computer floppy disk (either MS-DOS or Apple II format) which contains an electronic image of the paper form used for accreditation. This year the Bureau added to its electronic data collection the school class schedule. Approximately 400 high schools submitted class schedule information. Approximately 250 schools did not enter class schedule information.

Method

Two main objectives guided this research. The first was to determine whether the composition of the curriculum (in terms of core versus non-core courses) in Michigan high schools had changed in the direction advocated by the current reform movement. The second objective was to analyze the effect of the curricular changes on student outcomes (achievement and a proxy measure of student drop out).

We decided to use school level data corresponding to the following school years: 1979-80 (that is, three years before NAR), 1984-85 (one year after NAR, where schools would have had a chance to respond) and 1987-88 (three years after the initial reaction).[4] It is reasonable to expect that a 3-year chronological "band" surrounding the release of the report would provide an opportunity to observe school characteristics before the reform and after the reform was set in motion.

BASIS maintains an extensive data archive on school buildings and school districts. We paid particular attention to the school class schedule, school average student achievement scores on an essential skills state-mandated test, school enrollment, and expenditures per pupil.

Participants

Approximately 650 public and non-public Michigan high schools are accredited by The University of Michigan. Some 350 of those schools are also accredited by the NCA Michigan State Committee. A probability sample (n=61) was selected using as population the NCA-UM accredited high schools. Due to missing data two schools were dropped from the study. Complete accreditation records were located for the remaining 59 schools for the school years 1979-80, 1984-85 and 1987-88. Table 1 presents frequency counts of relevant variables.

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[4]When appropriate (see procedure section) we employed data from another school year.

Table 1
Frequency Counts of Several Variables

	School Year		
Variable	1979-80	1984-85	1987-88
Schools	59	59	59
Teachers	3,134	2,886	2,933
Courses taught	13,994	12,846	13,556
Student Class-periods	344,491	309,696	308,521

Procedure

Using the Michigan Association of Secondary School Principals (MASSP) course categories, the course offerings reported by schools were assigned to one of the following academic categories:

Table 2
MASSP Academic Categories

Code	Category
B	English/Language Arts
C	Social Studies
E	Mathematics
D	Science
F	Foreign Language
Q	Computers
G	Business
I	Industrial Art
L	Art
J	Music
M	Physical Ed.
V	Vocational Ed
Z	Other

We had to manually categorize over 40,000 courses. Usually, the categorization was straightforward such as identifying "Algebra I" as a math course. However, on numerous occasions we had to struggle with very cryptic names such as "M.H.S.(2)." Fortunately, we were helped by a BASIS staff person who has more than 30 years experience reading school transcripts for accreditation purposes. In a few occasions we had to call the school, or used (only as a last resource) the "other" category.

We must note that only broad categories were used. No specific courses were used. For example, both "biology" and "physics" were classified as science courses. We did not use a second-tier category to distinguish between all science courses. A second limitation of this study is that we were, in general, unable to make a determination as to whether the course was taught below grade level (remedial), at grade level (regular), or above grade level (advanced).

Once the courses were assigned to a curricular area, we proceeded to calculate, for each school and for each one of the three years under consideration, the total student-class periods in each one of the curricular areas. To illustrate, consider Allegan High School, a six-period school that in 1984-85 enrolled 570 students. The maximum possible student-class periods would be 570 X 6 = 3,420. Due to part-time and special ed. students, the actual number of student-class periods was a little less, 3,265. Out of those, 583 were assigned to English/language arts.

The next step was to calculate the percent of student-class periods (ps-cp) in each one of the curricular areas. This was a simple calculation. For example, in 1984-85, Allegan's ps-cp in English/language arts was 17.86%. These data would allow us to evaluate the effectiveness of the reform movement, at least regarding the immediate goal of changes in course-taking patterns.

Results 1: Changes in Course-Taking Patterns

School data were combined to calculate sample statistics regarding ps-cp. Table 3 contains the average school ps-cp for each one of the curricular areas and for each one of the school years considered. The data show that from 1979-80 to 184-85 student enrollment increased in the four areas emphasized in NAR: math, science, computers and foreign language. It also shows that student enrollment decreased in all non-core areas.

Table 3
Course Enrollments

Curricular Area	SCHOOL YEAR 1979-80	1984-85	1987-88
Language Art	18.8	18.9	18.5
Social Study	15.3	14.1	15.1
Science	10.4	11.6	12.0
Mathematics	12.1	14.7	14.2
Foreign Language	3.4	5.0	5.2
Computers	0.2	0.9	1.0
Business	8.3	8.3	7.5
Industrial Arts	5.7	5.0	4.5
Music	3.8	3.6	3.6
Art	3.2	2.6	2.8
Physical Education	9.6	7.9	7.8
Vocational Education	1.8	1.5	1.3
Other	7.4	5.9	6.5

To determine statistical significance of the results, we ran a series of paired t-test analyses for selected curricular areas and groupings of curricular areas. First we established pairs using 1979-80 and 1984-85 school data to investigate the "short-term" results of the reforms. Second we established pairs using 1984-85 and 1987-88 school data to investigate the "mid-term" results of the reforms.

The individual curricular areas considered were: math, science, computers, foreign language, English/lang. arts, and social studies. The first four are the ones emphasized by NAR while the last two are traditionally considered part of the core curriculum, but were not emphasized by NAR. The grouping "Non-NAR" is made up of all the curricular areas except the four emphasized by NAR. Table 4 contains the results of the series of paired t-tests employed on the data.

Table 4
Short and Mid-Term Effects of School Reform On Curriculum Composition

	From 1979-80 to 1984-85 (Short Term)			From 1984-85 to 1987-88 (Mid-Term)		
Curricular Area	Change	t-Value	Reform	Change	t-Value	Reform
Mathematics	2.64	5.71**	YES	-.48	-1.34	NO
Science	1.15	3.45**	YES	.48	1.82	YES
Computers	.74	4.96**	YES	.06	.45	YES
Foreign Language	1.59	7.47**	YES	.20	.33	YES
English/Lang. Arts	.04	.08	n.a.	-.32	-.83	n.a.
Social Studies	-1.23	-2.03*	n.a.	1.06	1.81	n.a.
Non-NAR	-6.06	-10.95**	YES	-.26	-.59	YES

* Paired t-test, 58 DF, P <.05
** Paired t-test, 58 DF, P <.01

In Table 4, the column "Reform" contains the label YES when the value in the column "Change" corresponding to that row agrees with the immediate goals of the reform movement. Thus, in the first half of the table (corresponding to short term results), enrollment in math courses increased 2.64% and the corresponding "Reform" label is YES. However, in the second half (corresponding to mid-term results), enrollment in math courses declined 1.34% which is contrary to the immediate goals of the reform movement. In this case, the corresponding "Reform" label is NO.

In general, changes in course-taking patterns agree with the immediate goals of the reform movement both in the short term and in the mid term. However, short-term changes are much greater than mid-term changes, attaining statistical significance at the $p < .01$ level in all cases relevant to the reform movement. This chronological effect is compatible with the notion that the changes observed were instigated by the reform movement, particularly by *A Nation at Risk*. What are the consequences of these changes in course-taking patterns on student achievement? Next, we examine this issue.

Results 2: Student Achievement and Course-Taking Patterns

First we examine the hypothesis that student achievement is associated with course enrollment. Due to the nature of accreditation data, we cannot examine this hypothesis using student level data. However, the random selection of schools employed in this study allow us to justify the use of school level data to study aggregate student achievement effects.

As a measure of student achievement we used both ACT and MEAP test results. The Michigan Education Assessment Program is a state-wide, minimum performance testing program. Because MEAP testing occurs at the beginning of the school year, it would not be proper to consider both course enrollment and MEAP data for the same year. Indeed, if the hypothesis to be tested is that "course enrollment affect student achievement," then we need to consider the course enrollment of a certain year and the MEAP scores of the following year. That is precisely what we did.

We obtained for each school the MEAP average on both math and reading for the school years 1985-86 and 1988-89. We decided not to include, in this first analysis, the data preceding the release of NAR. Table 5 contains the product-moment correlations between math enrollment and MEAP math scores and between English/language arts enrollment and MEAP reading scores. The table indicates that no correlation is significant. Indeed, three out of four correlations have, contrary to what is expected by the hypothesis, negative values. A negative correlation means that the more courses you take, in say math, the lower the test scores you will get.

Table 5
Student Achievement:
Product Moment Correlation Between Course Enrollment and Essential Skills Test Results

		MEAP Test	
Course Enrollment		Math	Reading
1987	Math	.0476	
	English/L.A.		-.0540
1984	Math	-.0918	
	English/L.A.		-.1831

Actually, Table 5 does not really test the hypothesis that increases in course enrollment will be followed by increases in student achievement. For example, it may be that schools that have high math enrollment in 1987-88, had an even higher math enrollment the previous year. The hypothesis of changes in course-taking patterns is not tested by looking at year percentages. What is required is to compare changes in course enrollment with changes in student achievement. This type of data would be able to determine if a school that has increased its student math enrollment, has also experienced an increase in student achievement.

Bacharach (1990) observes that it might be false to conclude that the recent increase in test scores in America has been caused by tightened-up standards, or that the previous decrease was caused by overly loose curricula. Other coincidental factors may have caused the recent increse or the previous decrease. He says that "until our measurement techniques have improved, we are not likely to find the answers."

We believe that the conjoint comparison of *changes* in both course enrollment patterns and student achievement provides a marked improvement over previous measurement techniques.

Table 6 contains an analysis of the relationship between changes in course enrollment and corresponding changes in two types of test scores: MEAP and ACT. The data used in Table 6 were generated as follows: the 1984-85 percent student-class period (ps-cp) in math

was substracted from the corresponding 1987-88 data for each school. A similar operation was performed on English/language arts and the combined percents of math, science, computers and foreign language (the NAR key courses). The result is called the change in ps-cp between 1984-85 and 1987-88. Similarly, the 1985-86 MEAP math score was substracted from the 1988-89 MEAP math score for each school. The result is called the change in MEAP math associated with changes in course enrollment patterns. A similar operation was performed on MEAP reading scores and ACT composite, ACT English and ACT math scores.

Table 6
Product Moment Correlation Between Changes in Course Enrollment and Changes in Student Achievement

	MEAP Test		ACT		
Course Enrollment	Math	Reading	Composite	Math	English
Math	.0476			.0853	
English/L.A.		-.0540			.0580
NAR Courses	-.0166	-.3961*	-.1666	.1163	-.1752

* $p < 0.5$, $N = 59$

The data present strong evidence that one of the basic tenets of the most recent reform movement is flawed. Within the range of values observed in today's high schools (there is no reason to suspect that Michigan is an exception), an increase in student enrollment in the key curricular areas identified in NAR will not produce increased student achievement. On the contrary, a consistent (and, at least once, statistically significant) negative association exists between the student enrollment in English/language art courses and student achievement in English and reading tests.

Conclusions

We found that curriculum composition has changed in the direction proposed by NAR. That is, there has been a steady and significant increase in the offerings and enrollment in the following areas: math, science, foreign language and computers. At the same time

there has been a steady decline in both offerings and enrollment in the following areas: business ed, industrial arts, art, physical ed. and vocational ed.

Regarding outcomes, we found that increases in math courses (both offerings and participation) are not accompanied by increases in math test scores. More puzzling, increases in language art courses appear to be accompanied by declining reading scores, at least on the minimum competency test (MEAP).

Educational Importance of the Study

Equally important, we found that the relationship between test scores and the number of courses taken in a given discipline is not so direct and may even be counter intuitive. Planners and critics who thought they had found a magic wand need to look further.

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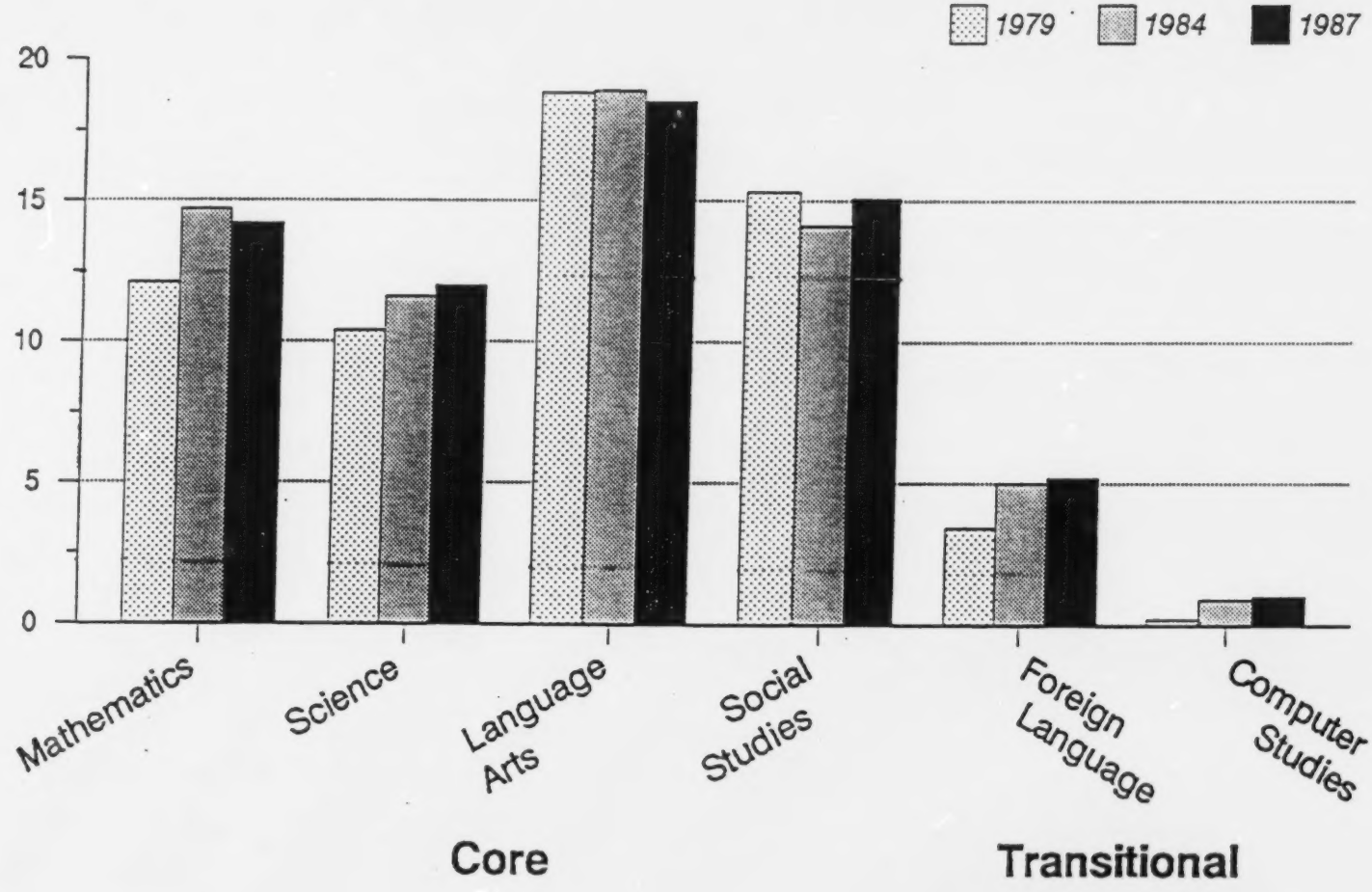
Core and Transitional Categories

Percent Enrolled



Non-Core Category

Percent Enrollment